EVB71071

315/433MHz Transmitter
Evaluation Board Description

General Description

The TH71071 antenna board is designed to optimally match the differential power amplifier output to a loop antenna. The TH71071 board is populated for ASK transmission.

The evaluation board contains a differential-drive loop antenna printed on the PCB (Printed Circuit Board). The size of the loop antenna is matched to the resonant frequency.

Board layout data in Gerber format is available on request.

Features

- ❑ Fully integrated, PLL-stabilized VCO
- ❑ Flexible frequency range from 310 MHz to 440 MHz
- ❑ ASK achieved by on/off keying of internal power amplifier
- ❑ Wide power supply range from 2.2 V to 5.5 V
- ❑ High over-all frequency accuracy
- ❑ Very low standby current
- ❑ Adjustable equivalent radiated power (ERP) range from -25 dBm to -10 dBm
- ❑ Adjustable current consumption from 4.8 mA to 11.5 mA
- ❑ Differential output well-suited for loop antenna
- ❑ Conforms to EN 300 220 standard

Ordering Information

Part No.

EVB71071-433

EVB71071-315

Applications

- ❑ Keyless car and central locking
- ❑ Low-power telemetry
- ❑ Alarm and security systems
- ❑ General digital data transmission
- ❑ General analog audio signal transmission

Theory of Operation

General

As depicted in Fig.1, the TH71071 transmitter consists of a fully integrated voltage-controlled oscillator (VCO), a divide-by-32 divider (div32), a phase-frequency detector (PFD) and a charge pump. An external loop filter at pin LF determines the dynamic behaviour of the PLL and suppresses reference spurious signals.

The VCO's output signal feeds the power amplifier (PA). RF signal power P_o can be adjusted in six steps from P_o = –12 dBm to +2 dBm either by changing the value of resistor R_1 or by varying the voltage V_{PS} at pin PS/DATA. The open-collector differential output (OUT1, OUT2) can be used to either directly drive a loop antenna or to be converted to a single-ended impedance by means of a balanced-to-unbalanced (balun) transformer. For maximum available output power, the differential output should be matched to a load of approx. 1 kΩ.

Bandgap biasing ensures stable operation of the IC at a power supply range of 2.2 V to 5.5 V.

ASK Modulation

The TH71071 can be ASK-modulated by applying data directly at pin PS. This turns the PA on and off and therefore leads to an ASK signal at the output.

LO Source

Many applications require a stable RF source. For this purpose, the TH71071 can be used without modulation as an easy-to-use, PLL-stabilized, continuous wave (CW) generator.

Mode Control Logic

The mode control logic allows two different modes of operation as listed in the following table. The mode control pin ENTX is pulled-down internally. This guarantees that the whole circuit is shut down if this pin is left floating.

ENTX	Mode	Description
0	TX disabled	whole circuit in standby
1	TX enable	TX active

Table 1: Modes of operation

Output Power Selection

typical values at T_a = 23 °C and V_{cc} = 3 V:

R1 / kΩ	0	7.5	11	15	24	43
R2 / kΩ	∞	4.7	4.7	4.7	4.7	4.7
V_{PS} / V	≥ 2	1.1	0.9	0.7	0.5	0.3
I_{cc} / mA	11.5	8.6	7.3	6.2	5.3	4.8
P_o / dBm	2	-1	-4	-7	-10	-12
P_{harm} / dBm	≤-40	≤-40	≤-40	≤-45	≤-45	≤-50

Table 2: Output Power Selection

If the transmitter is operated at any supply voltage V_{cc}, the values for R_1 and R_2 can be calculated as allows:

$$R_1 = R_2 \bullet \left(\frac{V_{cc}}{V_{PS}} - 1 \right)$$

For more detailed information, please refer to the latest TH71071 data sheet revision.

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Block Diagram

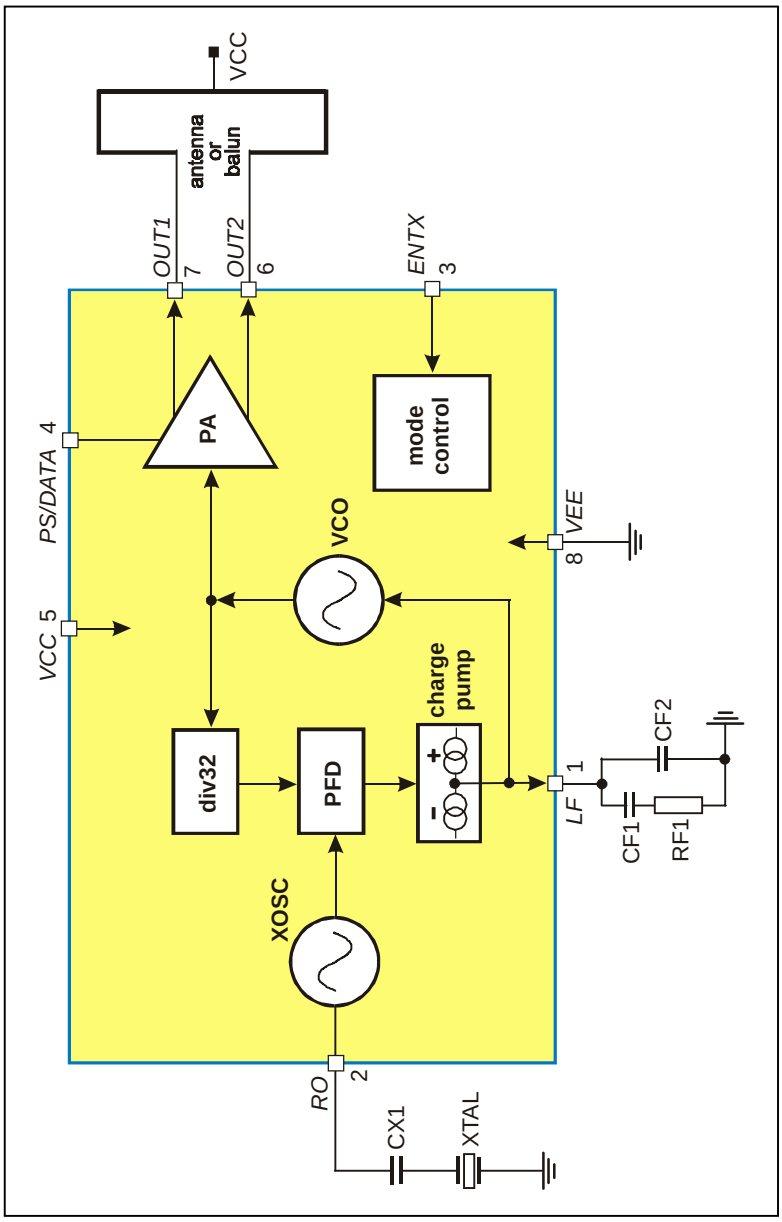
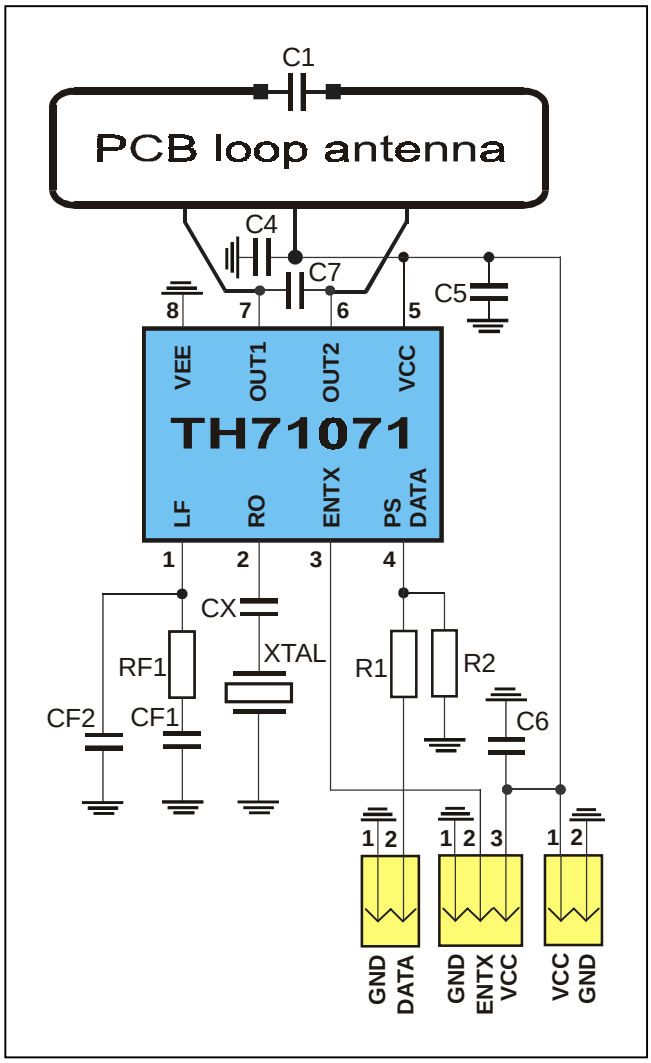
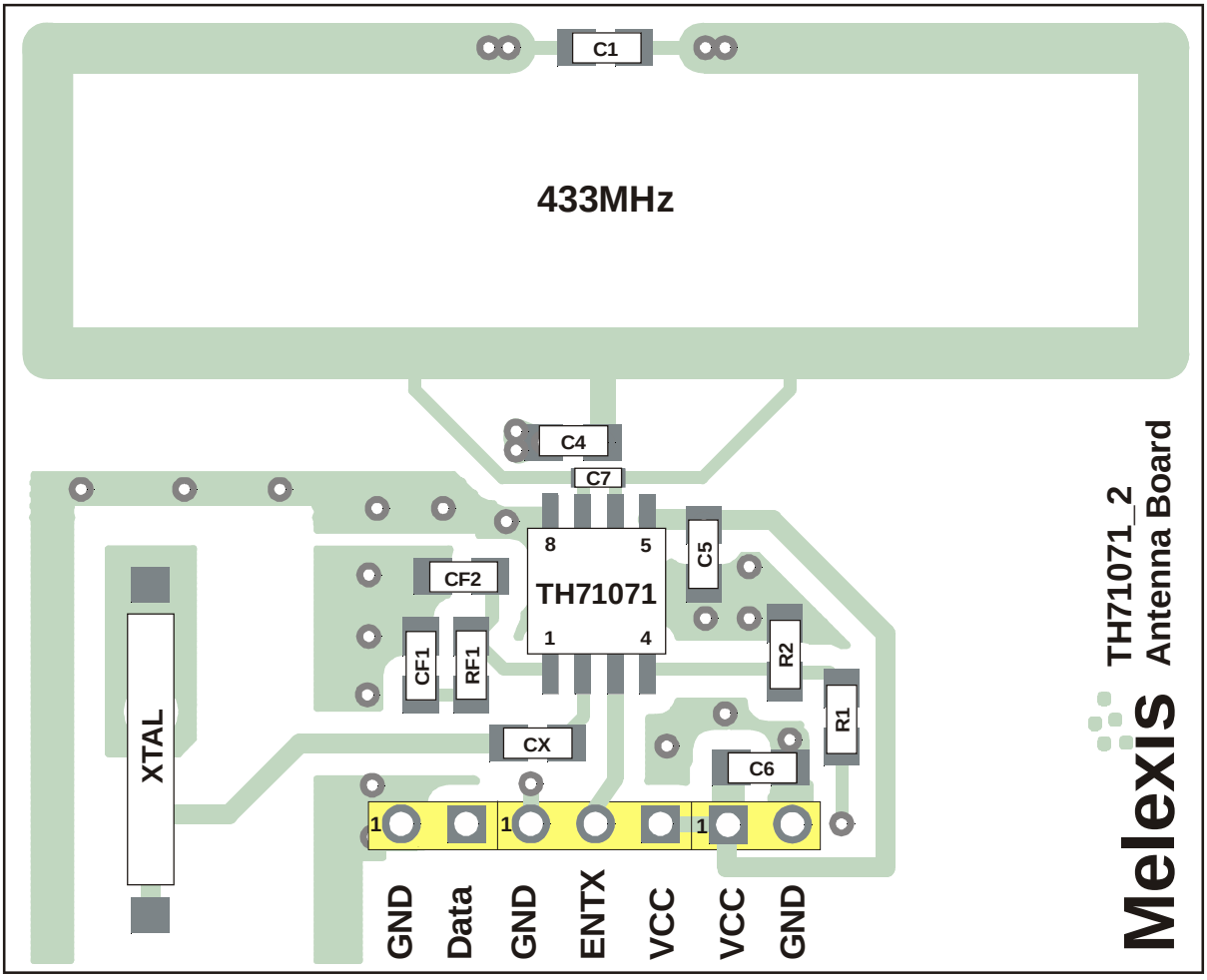


Fig. 1: TH71071 block diagram with external components

Circuit Diagram



PCB Top View



Board size is 47mm x 33mm

Board Connection

VCC	Power supply (2.2 V to 5.5 V)	**ENTX**	Mode control pin (see table 1)
DATA	Input for ASK data (CMOS)	**GND**	Several ground pins

Board Component Values

Part	Size	Value 315 MHz	Value 433.6 MHz	Tolerance	Description
CF1	0805	10 nF	10 nF	±10%	loop filter capacitor
CF2	0805	56 pF	56 pF	±10%	loop filter capacitor
CX	0805	47 pF	47 pF	±5%	XOSC capacitor for ASK, trimmed to f_C
C1	0805	TBD (or 2.5-6 pF trimming cap)	1.8 – 2.2 pF (2.5-6 pF trimming cap)	±2%	antenna tuning capacitor
C4	0805	330 pF	150 pF	±10%	blocking capacitor
C5	0805	330 pF	150 pF	±10%	blocking capacitor
C6	0805	220 nF	33 nF	±10%	blocking capacitor
C7	0603	TPD	4.7 pF	±5%	antenna tuning capacitor
RF1	0805	1.5 kΩ	1.5 kΩ	±10%	loop filter resistor
R1	0805	24 kΩ see table 2	0 Ω see table 2	±10%	ASK power-select resistor, not requirement at CW mode, See output power selection table
R2	0805	4.7 kΩ see table 2	NIP see table 2	±10%	ASK or CW mode power-select resistor
XTAL	HC49/S	9.8438 MHz fundamental wave	13.5500 MHz fundamental wave	±30ppm calibration ±30ppm temp.	crystal, C_{load} = 12 pF to 15 pF, $C_{0, max}$ = 7 pF, $R_{m, max}$ = 40 Ω
PCB loop antenna	long side length	TBD	46 mm		on FR4 PCB material side length including length of C1
PCB loop antenna	small side length	TBD	14 mm		on FR4 PCB material
PCB loop antenna	Line width	2 mm	2 mm		on FR4 PCB material

NIP – not in place, may be used optionally

The listed component values are default values. All values might be changed to fit to any specific application.

Pads for C1 are for population of a fixed-value capacitor with size 0805 or a to use trimming capacitor either.

Package Information

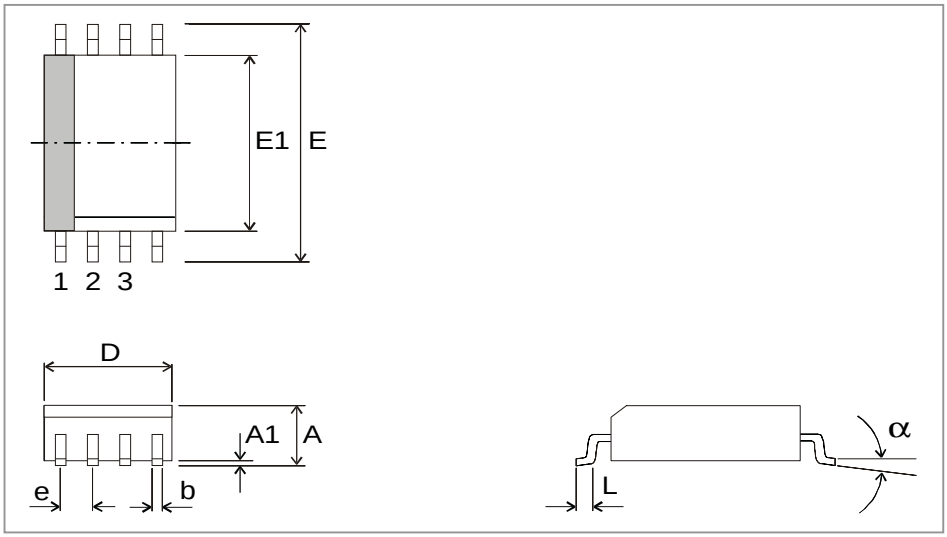


Fig. 2: SOIC8

all Dimension in mm, coplanarity < 0.1mm									
	D	E1	E	A	A1	e	b	L	α
min	4.80	3.81	5.80	1.32	0.10	1.27	0.36	0.41	0°
max	4.98	3.99	6.20	1.72	0.25		0.46	1.27	8°
all Dimension in inch, coplanarity < 0.004”									
min	0.189	0.150	0.2284	0.060	0.0040	0.05	0.014	0.016	0°
max	0.196	0.157	0.2440	0.068	0.0098		0.018	0.050	8°

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